

What is claimed is:

- 1                   1.     A method for making a remote copy between a first storage  
2 subsystem and a second storage subsystem which are connected to each other via a path,  
3 the first storage system connected to a first host, the method comprising the steps of:  
4                   providing a first logical volume to the first storage subsystem and a second  
5 logical volume to the second storage subsystem, the second logical volume being a copied  
6 logical volume of the first logical volume, the first logical volume and the second logical  
7 volume being in sync state,  
8                   making a third logical volume in the first storage subsystem, the third  
9 logical volume being a copied logical volume of the first logical volume, the first logical  
10 volume and the third logical volume being in sync state,  
11                  making a fourth logical volume in the second storage subsystem, the fourth  
12 logical volume being a copied logical volume of the second logical volume, the second  
13 logical volume and the fourth logical volume being in sync state,  
14                  breaking the sync state between the first logical volume and the third  
15 logical volume and between the second logical volume and the fourth logical volume  
16 based on a command, and  
17                  synchronizing the fourth logical volume with the third logical volume.
- 1                   2.     The method of claim 1, further comprising:  
2                   providing a first auxiliary host at the first storage subsystem, the first  
3 auxiliary host having permissions to access the third logical volume;  
4                   providing a second auxiliary host at the second storage subsystem, the  
5 second auxiliary host having permissions to access the fourth logical volume; and  
6                   executing applications using the first auxiliary host, the second auxiliary  
7 host, the third logical volume and the fourth logical volume.
- 1                   3.     The method of claim 2, wherein  
2                   executing applications comprises performing data recovery testing, and  
3                   making a third logical volume in the first storage subsystem comprises  
4 storing a test copy of data used by the first host on the third logical volume, and  
5                   making a fourth logical volume in the second storage subsystem comprises  
6 forming a mirror image of data in the third logical volume on the fourth volume.

1                   4.     The method of claim 3, wherein  
 2                   data recovery testing comprises:  
 3                   simulating a disaster at the first auxiliary host; and  
 4                   testing backup of information from the third logical volume to the fourth  
 5                   logical volume, and recovery there from.

1                   5.     The method of claim 2, wherein  
 2                   executing applications comprises performing data mining, and  
 3                   making a third logical volume in the first storage subsystem comprises  
 4                   establishing on the third volume a data warehouse having a copy of on line transactions  
 5                   processing (OLTP) data used by the first host, and  
 6                   making a fourth logical volume in the second storage subsystem comprises  
 7                   forming a mirror image of data in the third logical volume on the fourth volume.

1                   6.     The method of claim 5, wherein  
 2                   data mining comprises:  
 3                   establishing a data warehouse having a copy of on line transaction  
 4                   processing data at the first auxiliary host; and  
 5                   performing data analyses on the data warehouse information, and  
 6                   performing backups and/or recovery of the data warehouse information of  
 7                   the third logical volume to the fourth logical volume.

1                   7.     The method of claim 1, further comprising:  
 2                   determining if the sync state between the first logical volume and the  
 3                   second logical volume is an asynchronous mirror, and if so:  
 4                   inhibiting sending of further write data from the first storage subsystem to  
 5                   the second storage subsystem;  
 6                   recording incoming write data at the first storage subsystem; and  
 7                   re-synchronizing the first logical volume and the second logical volume  
 8                   after breaking the sync state between the second logical volume and the fourth logical  
 9                   volume.

1                   8.     The method of claim 1, wherein  
 2                   synchronizing the fourth logical volume with the third logical volume  
 3                   comprises:

4 issuing a command to form a mirror with a no copy option; and  
5 creating a new copy management storage area for the mirror.

1 9. A computer readable storage medium having stored thereon an  
2 atomic split command, comprising:  
3 a primary volume id (PVOL ID) indicating a primary volume (PVOL); and  
4 a secondary volume id (SVOL ID) indicating a secondary volume  
5 (SVOL).

1 10. The computer readable storage medium of claim 9, wherein  
2 the primary volume id comprises a serial number of a storage system; and  
3 a volume serial number within the storage system.

1 11. An apparatus, comprising:  
2 a first means for storing data;  
3 a second means for storing data, being remotable from and a copy of  
4 content of the first means for storing data, and being in a sync state with the first means  
5 for storing data;  
6 a third means for storing data, co-located with and a copy of content of the  
7 first means for storing data, and being in a sync state with the first means for storing data;  
8 a fourth means for storing data, co-located with and a copy of content of  
9 the second means for storing data, and being in a sync state with the second means for  
10 storing data;  
11 a means for breaking the sync state between the first means for storing  
12 data and the third means for storing data and between the second means for storing data  
13 and the fourth means for storing data; and  
14 a means for synchronizing the fourth means for storing data with the third  
15 means for storing data after breaking the sync state.

1 12. The apparatus of claim 11,  
2 further comprising:  
3 a means for creating an atomic split command, the command comprising:  
4 an identity of a first means for storing data to serve as a primary volume;  
5 and

6 an identity of a second means for storing data to serve as a secondary  
7 volume.

1 13. The apparatus of claim 11,  
2 further comprising:  
3 a means for creating an atomic split command, the command comprising:  
4 a first remote mirror, ORA\_R1, comprised of the first means for storing  
5 data and the second means for storing data;  
6 a second remote mirror, ORA\_R2, comprised of the third means for  
7 storing data and the fourth means for storing data;  
8 a first local mirror, ORA\_L, comprised of the first means for storing data  
9 and the third means for storing data; and  
10 a second local mirror, ORA\_RL, comprised of the second means for  
11 storing data and the fourth means for storing data.

1 14. A method, comprising:  
2 establishing a first remote mirror between a first logical unit in a first  
3 storage system and a second logical unit in a second storage system,  
4 establishing a first local mirror between the first logical unit and a third  
5 logical unit in the first storage system;  
6 establishing a second local mirror between the second logical unit and a  
7 fourth logical unit in the second storage system;  
8 splitting the first local mirror and the second local mirror; and  
9 establishing a second remote mirror between the third logical unit and the  
10 fourth logical unit.

1 15. The method of claim 14, wherein  
2 using the logical volumes of the first remote mirror for production  
3 processing; and  
4 using the logical volumes of the second remote mirror for testing.

1 16. The method of claim 14, wherein  
2 using the logical volumes of the first remote mirror for on line transaction  
3 processing; and  
4 using the logical volumes of the second remote mirror for data mining.

1                   17.    The method of claim 14, wherein  
 2                   establishing a second remote mirror between the third logical unit and the  
 3 fourth logical unit comprises:  
 4                   issuing a create mirror command with a no copy option; and  
 5                   creating a new copy management information store for managing  
 6 mirroring between the third logical unit and the fourth logical unit.

1                   18.    The method of claim 14, wherein  
 2                   splitting further comprises:  
 3                   determining whether the first remote mirror is asynchronous, and if so:  
 4                   copying all pending information to the second storage system.

1                   19.    A plurality of remote copy mirrors formed according to the method  
 2 of claim 1.

1                   20.    A plurality of remote copy mirrors formed according to the method  
 2 of claim 14.

1                   21.    A computer program product, comprising:  
 2                   code for establishing a first remote mirror between a first logical unit in a  
 3 first storage system and a second logical unit in a second storage system,  
 4                   code for establishing a first local mirror between the first logical unit and a  
 5 third logical unit in the first storage system;  
 6                   code for establishing a second local mirror between the second logical unit  
 7 and a fourth logical unit in the second storage system;  
 8                   code for splitting the first local mirror and the second local mirror;  
 9                   code for establishing a second remote mirror between the third logical unit  
 10 and the fourth logical unit; and  
 11                   a computer readable storage medium for holding the codes.